NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

March 31, 2014

Medical Factual Report

Mary Pat McKay, MD, MPH
Chief Medical Officer

A. ACCIDENT: DCA14MR002

Accident Type:	Train Derailment
Location:	Spuyten Duyvil Station, Bronx, NY
Date:	December 1, 2013
Time:	7:19am
Train#1:	8808
Carrier #1:	Metro North Railroad

B. GROUP IDENTIFICATION:

Mary Pat McKay, MD, MPH
Group Chairman
Chief Medical Officer
National Transportation Safety Board

Bernard Arseneau, DO, MPH
Medical Director
Federal Railroad Administration

C. SUMMARY

At 7:19 a.m. eastern standard time on Sunday, December 1, 2013, southbound Metro-North Railroad (MNR) passenger train #8808 derailed at milepost 11.35 on track number 2 of the MNR Hudson Line. The train originated in Poughkeepsie, NY with a destination of Grand Central Station in New York City. It consisted of 7 passenger cars and 1 locomotive at the rear in a push configuration. All 7 passenger cars and the locomotive derailed. The derailment occurred in a 6 degree left hand curve where speed was limited to 30 mph. Event recorder data indicates that the train was traveling at 82 mph when it derailed. As a result of the derailment, 4 passengers were killed and 59

persons were transported to local hospitals for injuries. Metro North estimated there were about 115 passengers on the train at the time of the derailment.

Damage was estimated by Metro North at over $9 million. The weather at the time of the accident was reported as 39 degrees with cloudy skies. Visibility was clear.

The parties to the investigation include Metro-North Railroad, the Federal Railroad Administration, New York Public Transportation Safety Board, Teamsters Local 808, New York Police Department, New York Fire Department, New York Office of Emergency Management and Bombardier Transportation.

D. DETAILS OF INVESTIGATION

1. Purpose of Study

Medical evaluation of the engineer of the derailed train.

2. Methods

The Metro-North medical protocols, as well as Metro-North's medical records regarding the engineer and post-accident emergency department medical records were reviewed. In addition, pre- and post-accident medical records were obtained regarding the engineer, and the results from post-accident sleep evaluation and polysomnography (sleep study) were obtained and reviewed.

3. Relevant Regulation and Guidelines

A. Federal Regulation

Per the Code of Federal Regulations (Title 49 CFR part 240.121), triennially, railroad engineers are required to meet the following criteria:

> (b) *Fitness requirement.* In order to be currently certified as a locomotive engineer, except as permitted by paragraph (e) of this section, a person's vision and hearing shall meet or exceed the standards prescribed in this section and appendix F to this part.

Federal regulations do not require any other medical evaluation or testing. In regard to medication, Title 49 CFR part 219.103(a) allows the use of controlled and other substances if -

> (1) The treating medical practitioner or a physician designated by the railroad has made a good faith judgment, with notice of the employee's assigned duties and on the basis of the available medical history, that use of the substance by the employee at the prescribed or authorized dosage level is consistent with the safe performance of the employee's duties;
> (2) The substance is used at the dosage prescribed or authorized; and

(3) In the event the employee is being treated by more than one medical practitioner, at least one treating medical practitioner has been informed of all medications authorized or prescribed and has determined that use of the medications is consistent with the safe performance of the employee's duties (and the employee has observed any restrictions imposed with respect to use of the medications in combination).
(b) This subpart does not restrict any discretion available to the railroad to require that employees notify the railroad of therapeutic drug use or obtain prior approval for such use.

B. Metro-North Medical Guidelines

A copy of Metro-North's internal protocol, "Medical Guidelines For Locomotive Engineer" was obtained from Metro-North. This document notes, "Prepared by: Human Resources Department Testing and Validation Unit, February 15, 1995" on the cover page. According to Metro-North, this is the most recent copy of these guidelines. On page two of this document, there is the following paragraph:

> "Medications or treatment for chronic conditions may produce side effects that can interfere with performance of essential job functions. Therefore, the physician should evaluate the effects of medications (both acutely or on a long-term basis) on worker safety and ability to effectively perform the essential job functions above (e.g., medications whose side effects may include potential for dizziness, impaired coordination, decreased alertness, and/or loss of consciousness). Use of certain categories of OTC and prescription drugs are prohibited for Locomotive Engineers in active service. Refer to CFR 49 for description of such medications. Any employee or candidate currently using any of these medications may not be qualified for service."

However, no such list of prohibited medications currently exists in Title 49 CFR. The only requirement is for post-accident drug testing which includes tests for these drugs: marijuana, cocaine, amphetamines, opiates, and phencyclidine, barbiturates, benzodiazepines, and antihistamines.

No mention is made in Metro-North's Medical Guidelines of sleep apnea or any sleep disorder. In regard to respiratory disease, the medical provider is given this list of requirements:

> "4. RESPIRATORY
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> A. Respiratory function adequate to support light physical activity in extreme temperature conditions.
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> B. Respiratory function (when clinically indicated) consistent with normal pulmonary function as defined by the American Thoracic Society (Class I or II):

1. Forced Vital Capacity (FVC) of at least 60% of predicted, and
2. Forced Expiratory Volume in 1 second as a function of FVC ($FEV_{1.0}$/FVC) of at least 60%.

C. The following respiratory conditions are potentially disqualifying and should be evaluated in terms of their ability to limit the individual's capacity for light physical activity and exacerbation by the conditions of the job (e.g., diesel fumes and smoke): asthma, bronchitis, and emphysema." (Pages 5-6)

4. Medical Findings regarding the Metro-North Engineer

A. Official Metro-North Medical Chart

The engineer underwent a preplacement physical for Metro-North October 11, 1999. According to the record from that visit, that time he was 32 years old, 5 feet 11 inches tall, and weighed 215 pounds. No Body Mass Index (BMI) was recorded. The engineer reported no medications or medical conditions; he did report smoking 4 cigarettes/day. Specifically, he answered "no" to questions 25 ("Excessive Worry, Depression or Difficulty with Sleep") and 27 ("Excessive Weakness or Fatigue") on Metro-North's medical history form. Testing revealed a blood pressure of 130/70 and a pulse of 90. His electrocardiogram (EKG) was interpreted as normal.

The engineer passed visual acuity testing and color vision testing without requiring corrective lenses. However, he demonstrated 25-45db high frequency hearing loss in the 4000-6000 Hz range. Metro-North requires pulmonary function testing as part of its preplacement physical; the engineer's lung function was well within the normal range. Blood work performed at this exam included a complete blood count, electrolytes, liver and kidney function tests, and a cholesterol test. His cholesterol was noted to be high and he was later sent a letter asking him to follow up regarding his cholesterol with his primary care doctor. However, he was qualified for duty by the examiner.

On 5/7/2003, he underwent a routine follow up physical for Metro-North. He again reported smoking cigarettes but did not report any other medical problems, medications, or symptoms. He answered "no" to questions 25 and 27. His height and weight are not reported in the record. His blood pressure was 140/84 and his heart rate was 85. The only physical exam reported was an eye exam; his visual acuity and color vision were normal. On the audiology test, he continued to demonstrate high frequency hearing loss. His EKG was interpreted as normal. Blood work was again performed and demonstrated high cholesterol. Another letter was sent to the engineer regarding the need to follow up with his primary care doctor.

On 5/25/2005, he underwent another routine follow up physical for Metro-North. He reported no medical problems, medications, or symptoms. He answered "no" to questions 25 and 27. His height and weight were recorded as 5 feet 11 inches and 223.5 pounds. No BMI was noted. His blood pressure was 128/80 and his heart rate was 87. The physical exam was essentially normal. The health care provider noted "continue weight loss" under "significant physical findings." His visual acuity and color vision were normal. On the audiology test, he continued to demonstrate high frequency hearing

loss greater on the right. His EKG and pulmonary function tests were interpreted as normal. A urine dipstick showed protein but was otherwise normal.

On 5/20/2008, the engineer underwent another routine follow up physical for Metro-North. He reported heartburn for which he was taking Prilosec and "FentraPhen (appetite suppressant)." He answered "no" to questions 25 and 27. His height and weight were recorded as 5 feet 11 inches and 204 pounds. No BMI was noted. His blood pressure was 110/80 and his heart rate was 94. The physical exam was essentially normal. The health care provider noted "mildly overweight" under "general physical appearance." His visual acuity and color vision were normal. On the audiology test, he continued to demonstrate high frequency hearing loss greater on the right. His EKG and pulmonary function tests were interpreted as normal. A urine dipstick showed protein but was otherwise normal.

On 5/3/2011, the engineer underwent his most recent routine physical for Metro-North. On the history form, he denied taking any medication but the health care provider noted, "Meds – Prilosec" and a number of herbal supplements. The health care provider also noted a "right knee injury meniscus injury 9/09," peptic ulcer, resolved, and GERD" (gastroesophageal reflux disease). He answered "no" to questions 25 and 27. His height and weight were recorded as 5 feet 11 inches and 246 pounds. No BMI was noted. His blood pressure was 116/80 and his heart rate was 78. The health care provider noted "overweight" under "general physical appearance." The physical exam was essentially normal. His visual acuity and color vision were normal. On the audiology test, he continued to demonstrate high frequency hearing loss greater on the right. His EKG and pulmonary function tests were interpreted as normal. A urine dipstick showed protein but was otherwise normal.

B. Primary Care Records:

Records were obtained from the engineer's primary care physician's office from June 2010 through December 2013. The following are excerpted data from those records. The engineer had gastroesophageal reflux disease for which he took Prilosec (omeprazole, a proton pump inhibitor) . He had persistently high cholesterol and was intermittently compliant with taking medication for it. At the time of the accident, he was not on cholesterol medication. He had been diagnosed with low testosterone but had stopped using the treatment for it due to concerns about side effects. Finally, following blood tests in May, 2013 the engineer had been diagnosed as having hypothyroidism (low thyroid hormone) and replacement thyroid hormone had been prescribed. In an interview with investigators following the accident, the engineer admitted he was only intermittently compliant with the treatment and that he sometimes missed doses. At no time was the engineer's blood pressure elevated. At no point during the pre-accident care did his health care providers document a discussion with the engineer regarding snoring, interrupted sleep, daytime sleepiness, or sleep pattern. The health care provider notes indicate that they knew their patient was employed as a train engineer.

i. Pre-accident care:

5/14/2013: Weight 274 pounds, Body Mass Index (BMI) recorded as 38.21 kg/m^2. Blood pressure 118/86. Regarding his high cholesterol, the author notes "Has tried to follow diet but has gained weight." Review of systems

"negative for anxiety, depression, and insomnia." Laboratory testing of fasting specimens showed high cholesterol and a glucose of 109 mg/dL (according to the lab report, upper limit of normal was 99 mg/dL).

11/15/2011: According to the record on this visit the engineer complained of "Pulled groin muscle, fatigue, rash." Weight 258 pounds. The fatigue was thought to be due to low testosterone. A blood test was performed and the testosterone level was found to be low. The engineer was prescribed testosterone containing gel and was placed on vitamins D and B12 for low blood levels of these vitamins as well.

9/8/2011: Provider notes recent laboratory reports: High cholesterol, Hemoglobin A1C elevated ,"+ prediabetes"[1]

8/31/2011: Lab results: Hemoglobin A1C 6.1%. (According to the lab report, "Increased risk for diabetes 5.7 - 6.4%.")[1] Glucose 108 mg/dL. According to the lab report, upper limit of normal was 100 mg/dL.

6/8/2010: Weight 238 pounds.

6/7/2010: Glucose 103 mg/dL. (According to the lab report, upper limit of normal was 99 mg/dL.)

ii. Post accident care

12/4/2013: Weight 261 pounds; Body Mass Index (BMI) recorded as 36.4 kg/m^2. At that time he reported having had a runny nose for the previous 5 days and said he had not taken any medication for it; the record notes he reported the symptoms were improving. He was diagnosed with an upper respiratory infection. The records note a sleep study had been ordered because the engineer did not exactly recall events leading up to the accident.

The report from laboratory analysis performed on specimens obtained 12/11/2013 showed a TSH (thyroid stimulating hormone) of 2.12 UIU/ml (normal 0.45 to 4.12 UIU/ml) and Free T4 of 1.01ng/dL (normal 0.76 – 1.46 ng/dL).[2] The Hemoglobin A1C was 6.2%.[1]

12/16/2013: The medical record contains a letter to the primary care physician from the examining Board Certified sleep specialist. See Section E. of this report for further information regarding this evaluation.

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[1] Hemoglobin A1C is a measurement of the proportion of hemoglobin molecules that have become glycosylated or had a glucose molecule attach to them. Normal is under 5.7%, Diabetes is diagnosed at 6.5%, and a result in between indicates abnormal glucose metabolism but not formal diabetes. For diabetics, "good" control of glucose is a Hemoglobin A1C less than 7%.

[2] Thyroid levels are managed by a feedback loop. Thyroid stimulating hormone (TSH) is secreted by the pituitary gland; in response, the thyroid secretes "T4," a thyroid hormone. A "Free T4" test measures the circulating level of the T4.

In addition, after the accident the medical record demonstrates the engineer underwent MRI scanning of his head and a Doppler ultrasound evaluation of his carotid arteries. These results were normal or negative for any neurologic disease.

C. Post-Accident Emergency Medical Care

The engineer was ambulatory at the scene of the accident and after he had talked with various agencies, he realized he was injured and was transported to a local hospital. There, they noted an abrasion on his back and he complained of shoulder pain. He underwent computerized tomography (CT scanning) of his abdomen and pelvis but no injury was identified. His blood glucose was measured at 132 mg/dL. According to the lab report, the upper limit of normal for the hospital lab is 100mg/dL

D. Post-Accident toxicological Testing

Blood and urine specimens were obtained following the accident and tested in routine fashion by the Toxicology Division at the Civil Aerospace Medicine Institute. The engineer was found to have chlorpheniramine in his blood (0.003 ug/ml) and chlorpheniramine and salicylate in his urine. Chlorpheniramine is a sedating antihistamine available over the counter under the brand names Chlor-Trimeton and Allergy Relief. The therapeutic dose ranges from 0.01 to 0.04 ug/ml. It carries the following FDA warning: "Warnings - may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery)."[3] The half-life for slow metabolizers may be as long as 43 hours, while for fast metabolizers it may be a low as 12 hours. Salicylate is a metabolite of aspirin, an over the counter analgesic and anti-platelet medication.

E. Details of the Post-Accident Sleep Evaluation

On 12/22/2013, the engineer underwent an evaluation by a Board-Certified Sleep Medicine physician and a non-invasive polysomnographic evaluation (sleep study). According to records from this evaluation, the engineer's Epworth Sleepiness Score was 12.[4] His height was recorded as 5 feet 11 inches and his weight at 244 pounds (BMI = 34.0 kg/m^2). notes the engineer had a history of snoring but not of choking or gasping arousals. The sleep specialist noted the engineer's recent work schedule change from late night to early morning shifts.

During the diagnostic portion of his sleep study, the engineer's overall apnea/hypopnea index (AHI) was 52.5 episodes/hour. The AHI rose to 67.5 episodes/hour when he was lying supine.[5] His normal oxygen saturation (when awake)

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[3] Federal Aviation Administration. Civil Aerospace Medicine Institute Toxicology Drug Information: Chlorpheniramine. http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=29 Accessed 3/18/2014.

[4] This is a standardized test used to describe the degree of sleepiness a person feels. It asks patients to describe how likely they are to doze in a variety of situations on a scale of "0 = would never doze" to "3 = high chance of dozing." See: http://epworthsleepinessscale.com/1997-version-ess/

[5] An apneic episode is the complete absence of airflow though the mouth and nose for at least 10 seconds. A hypopnea episode is when airflow decreases by 50 percent for at least 10 seconds or decreases by 30 percent if there is an associated decrease in the oxygen saturation or an arousal from sleep. The apnea-hypopnea index (AHI) sums the frequency of both types of episodes. An AHI of less than 5 is considered

was 97%; the lowest oxygen saturation during his sleep study was 87%. Overall, the records reflect that the engineer had "high sleep fragmentation with 64.7 sleep arousals per sleep hour" and that the primary cause of the sleep fragmentation was respiratory arousals.

The Sleep Medicine specialist found the engineer to have severe obstructive sleep apnea and prescribed continuous positive airway pressure (CPAP) as treatment. An additional statement in the specialist's repot reads, "Being a shift worker might have contributed to the accident."

During a follow up evaluation to assess the effectiveness of the treatment, the record notes the engineer used the CPAP for nearly 7 hours on each of the previous 30 days and that he was feeling more energetic. His Epworth Sleepiness Score had decreased to 1.

E. SUMMARY OF MEDICAL FINDINGS

Before the accident, the engineer had been diagnosed with hypothyroidism, high cholesterol, low testosterone, vitamin D and B12 deficiencies, and mild high frequency hearing loss. He was obese and his glucose levels and Hemoglobin A1C were persistently elevated although not diagnostic of diabetes. At the time of the accident, his BMI was 36.4 kg/m^2 and he had a mild upper respiratory infection; post-accident toxicology testing revealed a small amount of a sedating antihistamine and aspirin.

Post accident testing made an additional diagnosis of severe obstructive sleep apnea. No screening or evaluation for this diagnosis had been performed by any of his medical care providers prior to the accident.

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normal. An AHI of 5-15 is mild; 15-30 is moderate and more than 30 events per hour is considered severe sleep apnea.